Dr. Steven D. Vance

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Education

Ph.D. Astrobiology and Geophysics, University of Washington, 2007
Thesis title: High Pressure and Low Temperature Equations of State for Aqueous Sulfate Solutions: Applications to the Search for Life in Extraterrestrial Oceans, with Particular Reference to Europa.
Advisor: Prof. J. Michael Brown

B.S. Physics (with Honors), University of California, Santa Cruz, 2000
Thesis title: The Role of Methanol Frost in Particle Sticking and the Formation of Planets in the Early Solar Nebula. Advisor: Prof. Frank G. Bridges

Refereed Publications

Vance, S., L.E.Christensen and C.R. Webster and K. Sung. Biosignatures at Mars Analog Field Sites with *In Situ* Laser Spectroscopy: Laboratory Characterization and Detection of Methane, Ethane and Methyl Mercaptan from Serpentinization-Driven Springs at The Cedars. *in preparation.*

Vance, S., L. E. Christensen, C. R. Webster and K. Sung. Volatile Organic Sulfur Compounds as Biomarkers Complementary to Methane: Infrared Absorption Spectroscopy of CH_3SH Enables in Situ Measurements on Earth and Mars. *submitted to Planetary and Space Science.*

Vance, S. and K.P. Hand. Habitability of Icy Worlds. *in preparation.*

Vance, S., J.M. Brown and E.H. Abramson. Equations of State for Aqueous $MgSO_4$ to 2.0 m, 700 MPa from -20 to 100 ^{o}C. *in preparation.*

Sohl, F., M. Choukroun, J. Kargel, J. Kimura, R. Pappalardo, **S. Vance** and M. Zolotov, 2010. Subsurface Water Oceans in Icy Satellites: Chemical Composition and Exchange Processes. *Space Science Reviews, Europlanet Volume on Icy Satellites, in press.*

Vance, S. and J.M. Brown, 2009. Sound Velocities and Thermodynamic Properties of Water to 700 MPa and -20 to 100 ^{o}C. *JASA* **127**(1), 174-180.

Vance, S. and J. Goodman, 2009. Physical Oceanography of an Ice-covered Moon. *EUROPA*, University of Arizona Press.

Som, S. M., Z. R. Adam and **S. Vance**, 2009. Use the Water: In-Situ Resource Technology for Icy-Surface Landers. *Acta Astronautica* **64**, 1006-1010.

Dr. Steven D. Vance

Vance, S., and J.M. Brown 2008. The Icy Satellite Interior Simulator, an Apparatus for Optical Measurements in Aqueous Systems in the range -20 to 100 ^{o}C and 700 MPa. *Rev. Sci. Inst.* **79**(1), 105105.

Vance, S., J. Harnmeijer, J. Kimura, H. Hussmann, B. de Martin and J. M. Brown, 2007. Hydrothermal Systems in Small Ocean Planets. *Astrobiology* **7**(6), 987-1005.

Vance, S. 2005. Exploration & Characterization of Europa. *in* The Astrobiology Primer: An Outline of General Knowledge—Version 1, 2006. *Eds.* L.J. Mix, J.C. Armstrong, A.M. Mandell, A.C. Mosier, J. Raymond, S.N. Raymond, F.J. Stewart, K. von Braun, and O. Zhaxybayeva *Astrobiology* **6**, 735-813.

Vance, S. and J. M. Brown, 2005. Layering and Double-Diffusion Style Convection in Europa's Ocean. *Icarus* **177**, 506-514.

Funded Proposals (Co-I)

Astrobiology of Icy Worlds: Habitability, Survivability and Detectability, NASA Astrobiology Institute Cooperative Agreement Notice 5 (08-NAI5-0021), $8.18M, 2009–2013.

Thermochemistry of solutions relevant to icy satellites, NASA Outer Planets Research (NNX08AQ51G), $408K, 2009–2010.

Recent Research Experience

Habitability Lead, Icy Worlds Astrobiology Team — 2008–present
Dr. Isik Kanik — Jet Propulsion Laboratory, Pasadena
Coordinated multiple research efforts, by self and others, relating to the origin, sustenance and detectability of life in icy worlds.

Caltech Postdoctoral Fellow — 2009–present
Dr. Isik Kanik — Jet Propulsion Laboratory, Pasadena
Developed applications of diffusion mobility spectroscopy. Participated in astrobiology related work as part of the Europa Jupiter System Mission science definition team. Developed the science rationale for thermal instrument on the Jupiter Europa Orbiter for EJSM.

NASA Postdoctoral Fellow — 2007–2009
Dr. Chris Webster — Jet Propulsion Laboratory, Pasadena
Assisted with ground-based operation and developed scientific applications for the Mars Science Laboratory Tunable Laser Spectrometer. Investigated applications of new insights in physical chemistry to the structure and evolution of habitable planets.

Research Assistant — 2001–2007
Prof. J. Michael Brown and Dr. Evan Abramson — University of Washington, Seattle
Constructed and operated high-pressure instrumentation; collected and analyzed sound velocity data for aqueous solutions obtained by the method of impulsive stimulated scattering (ISS). Applied results to understanding physical processes in deep extraterrestrial oceans and hydrothermal systems.

Dr. Steven D. Vance

Research Associate 2003–2004
Prof. Jody Deming Canadian Arctic Shelf Exchange Study
Prepared and inventoried shipboard laboratory on *CCGS* Amundsen while frozen into Franklin Bay, Northwest Territories, Canada; collected and preserved ice core samples for characterizing winter intra-ice bacterial populations.

Research Associate 2003
Prof. Tilman Spohn Institut für Planetologie, Münster
Reviewed hydrothermal systems literature and investigated means for modeling permeability of extraterrestrial seafloors.

Research Associate 2001
Dr. Remington Stone UCO/Lick Observatory
Operated Nickel reflector telescope for acquisition of optical SETI data.

Research Assistant 1998-2001
Prof. Frank Bridges University of California, Santa Cruz
Designed and executed experiments investigating impact sticking of water- and methanol-frosted ices. Applied results to the problem of large-particle ($> cm$-size) formation in the early solar nebula.

Teaching Experience

Founder and Facilitator 2005-Present
UWAB Planetology Discussion Group University of Washington, Seattle
Organized weekly reviews of selected journal articles pertaining to the formation and evolution of solar and extra-solar system objects.

Teaching Assistant Winter 2004
Physics University of Washington, Seattle
114/121: Waves/Mechanics. Taught three sections, approximately 20 students per section.

Visiting Scientist 2002-2003
Project AstroBio Seattle
Presented two guest lectures for a Seattle fifth grade class of approximately 30 students.

Tutor 2002-2005
University Tutoring Service Seattle
Taught three undergraduate or high-school students per year on average. Topics included algebra, trigonometry, calculus, physical chemistry and introductory physics.

Teaching Assistant Spring-Summer, 2001
Physics Department University of California, Santa Cruz
5B Labs: Wave motion in matter, including sound waves. Taught two sections, approximately 20 students per section

Mathematics and Physics Tutor 1998-2001
Self-employed University of California, Santa Cruz
Taught two undergraduate or high-school students per year on average. Topics included econometrics, calculus and introductory physics.

Dr. Steven D. Vance

Service

Asia Oceania Geosciences Conference, 2010: Convener, PS03 Astrobiology and Ices. Convener, PS11 Satellites and Rings in the Outer Solar System.

Astrobiology Science Conference, 2010: Convener, Session P18: Potential Biomarkers on Mars: Detection, Characterization and Earth Analogue Systems

Lead Author, "Icy Satellite Processes in the Solar System: A plurality of worlds," white paper prepared for the 2009-2010 Planetary Sciences Decadal Survey.

American Geophysical Union, Fall Meeting, 2009: Convener, Session P18: Potential Biomarkers on Mars: Detection, Characterization and Earth Analogue Systems

NASA Outer Planets Research Program, 2009: Panel Reviewer

Lunar and Planetary Sciences Conference, 2009: Oral Session Chair, Special Session: Icy Satellites of Jupiter and Saturn: Cosmic Gymnasts

Asia Oceania Geosciences Conference, 2009: Convener, Astrobiology

Lunar and Planetary Sciences Conference, 2009: Convener, Oral Session Chair, Icy Ocean Worlds

AGU Congressional Geosciences Visits, September 2008: Participant

Asia Oceania Geosciences Conference, 2008: Convener, Oral Session Chair, PS08 Satellites and Rings in the Outer Solar System.

Astrobiology Science Conference, 2008:

- Convener, Oral Session Chair, Session 13. The Deep Cold Biosphere? Interior Processes of Icy Satellites and Dwarf Planets
- Convener, Session 2. Advances in Astrobiological Instrumentation Development

Lunar and Planetary Sciences Conference, 2008: Oral Session Chair, Titan

Lunar and Planetary Sciences Conference, 2007: Oral Session Chair, Astrobiology

American Geophysical Union Fall Meeting, 2006:

- Oral Session Chair, P31D, Once in a Blue Moon: The Surprising Diversity of Outer Planet Satellites I
- Poster Session Chair, P23E, Satellites, Rings, and Ices Posters

Awards and Honors

NASA Postdoctoral Fellowship, 2007-2009

Misch Fellowship, 2007

Stephens Graduate Support Grant, 2006

National Science Foundation IGERT/NASA Astrobiology Institute Grant, 2002-2005

Research support, University of Washington Alumni Grant, Winter / Spring, 2003-2004

Elks National Foundation Scholarship, 1996-2000 / Kern County Elks Scholarship, 1996

Howard and Mamie Nichols Scholarship, 1996-2000

Texaco Foundation Scholarship, 1996-2000

Dr. Steven D. Vance

Recent Oral Presentations

Vance, S., L. E. Christensen, O. J. Johnson, M. J. Russell and C. R. Webster, 2009. Laser Absorption Biosignatures on Mars and Earth. *Eos Trans. AGU, Fall Meet. Suppl.*, Abstract P41B-07 .

Vance, S., N. Goff-Pochat, G.C. Collins, 2009. Thermal Weathering and Erosion on Planetary Surfaces Asia Oceania Geosciences Symposium, Singapore.

Vance, S. 2009. Habitability of Icy Worlds: Electrochemical Capacitance of Serpentinizing Hydrothermal Systems. LPSC XL, Abstract 1994. Woodlands, TX.

Vance, S., 2009. Serpentinization and the Habitability of Ocean-Bearing Worlds. Colloquium for Virginia Tech, Geosciences Department. **INVITED**

Vance, S., 2009. Habitability of Icy Worlds. Colloquium for University of Southern California, Biology Department. **INVITED**

Vance, S., 2009. Habitability of Icy Worlds. Colloquium for University of Minnesota, Mankato, Geology Department. **INVITED**

Vance, S., 2009. Habitability of Icy Worlds. Planetary Sciences Seminar for Science Division, Jet Propulsion Laboratory, Caltech. **INVITED**

Vance, S., 2009. Serpentinization and the Habitability of Ocean-Bearing Worlds. Colloquium for Case Western Reserve University, Department of Geological Sciences. **INVITED**

Vance, S., 2008. Serpentinization and the Habitability of Ocean-Bearing Worlds. Colloquium for the University of California Irvine, Department of Earth System Sciences. **INVITED**

Vance, S., R.T. Pappalardo and J. Baross 2008. Pressure-induced Limits to Hydrothermal Activity in Small Ocean Worlds. Asia Oceania Geosciences Conference, Busan, South Korea.

Vance, S., 2008. Deep Cold Biospheres? Icy Worlds as Cool Places for Life Under Pressure. JPL Director's Seminar. **INVITED**

Vance, S., R.T. Pappalardo and J. Baross 2008. Long-Lived Serpentinization Activity in Habitable Icy Worlds. Astrobiology Science Conference, Santa Clara, CA. **INVITED**

J. Castillo-Rogez, **S. Vance (presenter)**, T. McCord, D. Matson 2008. Hydrothermal Activity: Effects On Evolution of Icy Worlds Focus on Ceres. Astrobiology Science Conference.

Vance, S., J. M. Brown and C. Sotin 2008. Laboratory Simulations of Titan's Internal Ocean. LPSC XXXIX, Abstract 2136. Houston, TX.

Vance, S., 2008. Improving our understanding of very deep oceans: $MgSO_4$ chemistry to 700 MPa from -20 to 100 ^{o}C. UCLA Earth and Space Sciences Seminar. **INVITED**

Dr. Steven D. Vance

Recent Poster Presentations

Vance, S., L. Christensen, O. Johnson, C. Webster, 2009. Mars Analog Tunable Laser Spectroscopy at a Site of Active Serpentinization. LPSC XV, Abstract 2005. Woodlands, TX.

Vance, S., L. Christensen, O. Johnson, P. Morrill and C. R. Webster, 2008. Mars Analog Tunable Laser Spectroscopy at a Site of Active Serpentinization *Eos Trans. AGU, Fall Meet. Suppl.*, Abstract P53C-1461

Vance, S., R.T. Pappalardo and J. Baross, 2008. Tidal Evolution and Hydrothermal Activity in Habitable Icy Worlds. Gordon Research Conference on the Origin of Life, Ventura, CA.

Vance, S., J. Harnmeijer, and J. M. Brown, 2006. The Depth of Fluid Circulation in Icy-Moon Hydrothermal Systems: Implications for Production of Heat and H_2 from Serpentinization. *Astrobiology* **6**, 217.

Vance, S., J. Harnmeijer, and J. M. Brown, 2005. Serpentinization-Driven Systems in the Seafloors of Icy Moons, *Eos Trans. AGU*, 86(52), Fall Meet. Suppl. Abstract P51D-0970.

Vance, S., and J. M. Brown 2004. Layering and Double-Diffusion Style Convection in Europa's Ocean. *Eos Trans. AGU*, **85**(47), Fall Meet. Suppl., Abstract P31A-0966.

Harnmeijer, J., and **S. Vance**, 2004. The Biopotential of Europa's Ocean: Contribution from Exogenous Sources. Bioastronomy Conference, Reykjavik, Iceland. *Astrobiology* **4**, 302.